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THE TANGENCY PROBLEMS.

BY PROF. JOSEPH H. KERSHNER, MERCERSBERG, PA.

WE are indebted to the Mathematical Collections of Pappus of Alexandria for a general account of the Course in Geometry prescribed, and partly created by Apollonius of Perga for his pupils, and universally adopted by the Ancients.

The curriculum commenced with the *Elements* and *Data*, and closed with the *Porisms*, each originally arranged by Euclid. After the *Data*, followed the Books of Apollonius in order thus: The *Section of Ratio*, *Section of Space*, *Determinate Section*, *Inclinations*, *Tangencies*, *Plane Loci*, divided into two Books each. Of all these, except a few meagre fragments, only the *Elements* and *Data* have escaped the tooth of Time. Attempts at restoration, by the greatest Geometers of later times, have met with more or less success. The two Books of Tangencies were devoted to the *Tangency Problem* of Apollonius: "*Of points, straight lines and circles, any three whatever being given in position, to draw a circle through each given point, which, if possible, shall also touch the given lines.*" The Tangency Problem of Pappus, designed as an introduction to these, is thus stated: "*Of points, straight lines and circles, any two whatever being given in position in the same plane, to draw a circle of given radius, which shall touch the given points, straight lines and circles.*"

Fermat has skirmished across into the hill-country of Solid Geometry with Tangencies: "*Of points, planes and spheres, some four being given in position, any two of the same, and any other two of any kind whatever, to draw a sphere which shall touch the four points, planes and spheres.*"

These problems come down to us with the accents of the ages. We think of them reverently when we consider that a large majority of all the great and good men the world has seen have labored at some, or all, of the original Tangency Problems.

NOTE.—It has been suggested that we call the attention of the readers of the ANALYST to such problems and queries as have been published therein and to which no solutions, or answers, have been given, so that persons not caring to look over all that has been published may know just where to find acceptable work in that line.

According to our recollection, attempts have been made, and published, to solve all the problems and answer all the queries, except prob. 68, p. 63, V. II, and the "Query by request" on p. 96, Vol. V. An answer to this query is specially solicited; and, also, further discussion of problems 47, 68, 96, 120, 132 and 169 would be acceptable.